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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/035,829	10/18/2001	Vlad J. Novotny	AONIP001C1	2508

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EXAMINER


STAHL, MICHAEL J

ART UNIT	PAPER NUMBER
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2874

DATE MAILED: 07/28/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/035,829	NOVOTNY ET AL.	
	Examiner	Art Unit	
	Mike Stahl	2874	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 April 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4-11,13-19 and 21-73 is/are pending in the application.
- 4a) Of the above claim(s) 56-68 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 6,22 and 43-50 is/are allowed.
- 6) ☒ Claim(s) 1,2,4,5,7-11,13-19,21,23,25-39,41,42,51-55 and 69-73 is/are rejected.
- 7) ☒ Claim(s) 24 and 40 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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This office action is in response to the amendment filed April 23, 2004. The changes to the specification and claims are acknowledged. Claims 1-2, 4-11, 13-19, and 21-73 are pending (claims 56-68 remain withdrawn from consideration). This action is not made final.

Information Disclosure Statement

The information disclosure statements submitted March 29 and April 23, 2004 have been considered. Initialed copies of the PTO-1449 forms are attached.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 51 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 51 as amended recites that each arm of the first serpentine-hinge is contoured to _____ coincide with the shape of the outside periphery of the frame element. However, base claim 43 refers to three distinct frame elements so it is not clear which frame element claim 51 refers to.

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Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 69-71 and 73 are rejected under 35 U.S.C. 102(b) as being anticipated by Plesko (US 5506394).

Claim 69: Plesko discloses an MEMS actuator comprising: a support structure 115/123; a movable optical element 52; and a plurality of serpentine hinges (part of suspension 48) extending between the movable optical element and the support structure, each hinge including a number of arms with a number of arm lengths. See figs. 16 and 17.

Claim 70: The arms are curved from a perspective normal to the optical element.

Claim 71: The arm lengths get progressively shorter from the support structure end to the optical element end.

Claim 73: The hinges define at least one axis of rotation, and at least one of the arms extends parallel to that axis (see e.g. the x-axis as defined in fig. 16).

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Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 72 is rejected under 35 U.S.C. 103(a) as being unpatentable over Plesko (cited above).

Plesko shows the arms of the serpentine hinges getting shorter from the support structure end to the optical element end, which is opposite to what claim 72 requires. However, this is not described as a critical aspect of that invention. It would have been obvious to a person having ordinary skill in the art to use any appropriate shape for the serpentine hinges. One motivation for having the arms increase in length as they proceed from the support structure end to the optical element end is that this would require a shorter overall hinge length and would advantageously reduce the amount of material needed.

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Claims 1-2, 4-5, 7-11, 13-19, 21, 23, 25-39, 41-42, and 52-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neukermans et al. (US 6445844) in view of McClelland et al. (US 6201629).

Claim 1: Neukermans discloses an apparatus (figs. 13-15) comprising an optical element **184** capable of motion in two degrees of freedom, wherein the motion is enabled by serpentine hinges **176** and **182**, and driving elements **214** configured to deflect the optical element. Neukermans does not disclose a specific damping element. McClelland discloses a similar optical deflector apparatus and teaches that the movable optical element may be damped by applying a damping material to various parts of the apparatus or by mechanically coupling separate damping devices to the moving structures (col. 13 lines 1-36). McClelland suggests that it may be desirable to provide higher damping for one of the rotation axes. Since the Neukermans apparatus is intended to be used in multiples in an optical switching array (see e.g. Fig. 18B), it would appear to be advantageous to damp one of the rotation axes particularly when the dimensions of the array are unequal. Thus it would have been obvious to a person having ordinary skill in the art to provide the Neukermans apparatus with a damping element as suggested by McClelland. The proposed modification meets the limitations of claim 1.

Claim 2: The optical element **184** is made from single crystal silicon (see e.g. claim 33; col. 15 lines 22-29).

Claim 4: A damping element is a damping means.

Claim 5: McClelland teaches application of a damping agent **57** to the hinges which define the rotation axes (fig. 14A). This teaching is incorporated into the proposed modification.

Claim 7: Optical element **184** includes a reflective surface **116**.

Claim 8: Neukermans discloses an array of the apparatuses of claim 2 (see e.g. figs. 16-18b and 20a-20b).

Claim 9: Since Neukermans characterizes the hinges **176** and **182** as torsional hinges, then at least one degree of freedom is enabled by at least one pair of torsional hinges.

Claim 10: Neukermans discloses incorporating the optical apparatus into a wavelength router (fig. 31; col. 36 lines 12-31).

Claims 11 and 14: The Neukermans array modified by the teachings of McClelland as proposed above meets the limitations of these claims. It is noted that the movable optical element and the hinges are formed in a common layer **166** (see figs. 12 and 15). The metal frame **224** (fig. 16a) can be regarded as a support structure.

Claim 13: The hinges **176** and **182** may be thinner than the optical element **184** (col. 17 lines 27-31).

Claim 15: The movable optical element **184** includes a mirror **116**.

Claim 16: The movable optical element may act as a blocker, by blocking beams propagating between input and output fibers.

Claims 17 and 18: See comments for claims 4 and 5 above.

Claim 19: The damping agent taught by McClelland may be a polymeric material (col. 13 lines 12-18).

Claim 21: A portion of each arm of each winding of each hinge extends in a direction transverse to the rotation axis defined by a respective hinge pair (figs. 13-14).

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Claim 23: The arms of each serpentine hinge have a proximal fold which shapes the proximal portion of each arm such that it extends in a direction parallel to the rotation axis defined by the respective pair of hinges.

Claim 25: Each winding of the serpentine hinges gets progressively shorter from the optical element end to the support structure end.

Claim 26: Although Neukermans does not specifically disclose each winding of serpentine hinges getting progressively longer from the optical element end to the support structure end, this is considered a matter of design which would have been obvious to a person having ordinary skill in the art.

Claim 27: The Neukermans array modified by the teachings of McClelland as proposed above meets the limitations of this claim. Inner moving frame 178 is a movable frame element (fig. 13). Electrodes 214 are the optical element driving elements. Frame driving elements are not specifically illustrated but are considered to inherently exist since the inner frame rotates and since the beam scanners are configured for scanning in two dimensions.

Claims 28-39, 41-42, and 52-55: The limitations of these claims are met by the modified Neukermans array as seen either by inspection or by reference to features which have already been identified above.

Response to Arguments

With regard to the previously applied Temesvary et al. reference, applicant has referred to the claim for priority to provisional application 60/241,269 which was filed October 17, 2000. The examiner has reviewed the provisional application, and notes that it discloses variable spring

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constant serpentine hinges. As the present specification points out, variable spring constant serpentine hinges provide vibrational damping. Therefore the effective date of the presently claimed subject matter precedes the effective date of the Temesvary reference, and the previous rejections relying on Temesvary have been withdrawn.

Allowable Subject Matter

Claim 6 is now allowed in view of the amendment to recast it in independent form incorporating its allowable subject matter identified in the last office action.

Claims 22 and 43-50 are presently allowed. Claims 24 and 40 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 51 would be allowable if rewritten to overcome the rejections under 35 U.S.C. 112, second paragraph, set forth above and to include all of the limitations of the base claim and any intervening claims. It is noted that claim 51 depends from allowed base claims.

As to claim 22, Neukermans does not disclose or suggest circumferentially curved hinges, but rather expresses a preference for aligning the hinges with a crystallographic axis of the single-crystal silicon as discussed in relation to figs. 18a-19b. Moreover, even though curved mirrors 184 are disclosed in 19a-19b, there is no depiction of the hinges 176 or 182 in those figures as conforming to the circumferential shape of the mirror.

As to claims 24 and 40, there is no disclosure or suggestion in Neukermans that the shape of the hinges 176 or 182 by itself contributes a damping effect.

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As to claim 43, none of the references of record teaches or suggests an optical apparatus which includes all of the recited structural elements. Claims 44-50 depend from claim 43.

Conclusion

US 5724015 is cited on the attached PTO-892 form since it is considered relevant to the disclosure.

Any inquiry concerning this communication should be directed to Mike Stahl at (571) 272-2360. Official communications which are eligible for submission by facsimile and which pertain to this application may be faxed to (703) 872-9306. Inquiries of a general or clerical nature (e.g., a request for a missing form or paper, etc.) should be directed to the technical support staff supervisor at (571) 272-1626.

MJS

Michael J. Stahl
Patent Examiner
Art Unit 2874


AKM ENAYET ULLAH
PRIMARY EXAMINER

July 12, 2004
